CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)
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Project Number
J0102

Project Title
Just Winging It

Abstract

Objectives/Goals
Our goal for this project was to determine if we could modify the top surface of a foam wing with uneven patterns such as dimples or ridges, and increase its performance at at measurable level.

Methods/Materials
For this project, we used 3" thick insulation foam, one sheet of Plexiglas cut in half lengthwise, and a high RPM fan to construct a wind tunnel. One-inch thick insulation foam was used to construct the wing prototypes. We designed and tested three wing types: dimpled, ridged and control; using a 1/2"drill bit to create the dimples and 40 grit sandpaper for the ridges. A postal scale was used to ensure equal weight of 0.45 oz for each wing. A potentiometer was needed to adjust the speed of the fan, and an Infrared RPM meter to measure the speed. We flew each wing at the lowest possible RPMs to stay aloft, and recorded the RPMs at the stall mark, determined to be 2"(5.08cm) from the floor of the wind tunnel. We ran 20 trials for each wing according to this protocol.

Results
The data from the test flights showed that the control wing averaged 1,032 RPMs to maintain pre-stall. The dimpled wing was the most efficient with an average 873 RPMs to pre-stall, a 15.4% decrease in RPMs compared to the control wing. The ridged wing averaged 1,123 RPMs to maintain pre-stall, an 8.8% increase in RPMs over the control wing.

Conclusions/Discussion
The results partially supported our hypothesis that by modifying the surface of a wing with an uneven dimpled pattern will increase aerodynamic efficiency, due to the fact that the ridged wing showed a decrease in efficiency from the control wing. The significance of this project in terms of real world applications includes design of a wing prototype using dimpling, that results in a lower stall speed, thereby enabling safer and lower speed take-offs and landings. This in turn may lead to decreased fuel cost and shorter runways needed for any aircraft in general. Other variables that could be refined/added to future testing are: additional uneven wing surface designs, conducting flight tests at different times of day, monitoring barometric pressure and temperature, a lower friction rail system, and a higher RPM fan.

Summary Statement
This project is about determining whether dimpling or ridges present on a wing's surface can decrease its stall speed.

Help Received
Cousin loaned tools and oversaw construction of wind tunnel; Father's co-worker assisted with modifying the fan; Mother assisted with double height display board.